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ABSTRACT

Discussed is the development of games which provide teacher-trainees with experience in anticipating the response of different types of handicapped children to different tasks, and reported are results of four studies evaluating the effects of such games. It is explained that the games are designed to improve understanding of students and that they provide immediate feedback based on empirical data. The process of developing anticipation games is described in three stages: analyzing people and situation, collecting normative data, and choosing a game format. Summarized are studies which investigated questions such as how accurately different groups of college students anticipated educable mentally retarded and nonretarded children's responses to a set of questions. (LS)

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DESIGN, DEVELOPMENT, AND VALIDATION OF ANTICIPATION GAMES[1]

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Abstract

Anticipation games require players to predict the behaviors of different subgroups of the target population in different situations. The players' success in the game is directly related to the accuracy of his anticipations in comparison to empirically established norms. At the Center for Innovation in Teaching the Handicapped, different versions of the anticipation games have been produced to help teachers better understand handicapped children in their classrooms. The design and development of these games involve the three stages of analyzing people and situations, establishing a normative data base, and selecting suitable game formats. A basic study on the anticipation of the responses of different types of children by college students indicates that sex, age, experience, and education are related to the accuracy of anticipation. Three studies on the learning and transfer effects of playing anticipation games suggest that while teacher-players improve on their accuracy of anticipations within the context of the game, transfer of this skill to their own classrooms is not at a significant level.

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Anticipation and Understanding

The pyschologist, the lawyer, the salesclerk, or any other professional has to understand his clientele in order to efficiently fulfill his role. Understanding, however, is a vague term and it may be partly operationalized through the notion of anticipation. The degree to which a person is able to anticipate accurately what is going to happen is a valid indicator of his understanding of people and events. There is ample evidence in the literature to indicate that individuals differ in the quality of their anticipations and that there is generally a positive correlation between the accuracy of anticipation and efficiency of performance. Anticipatory skill is of special importance to the teacher who has the duty of keeping his/her learners inside the optimal area between frustrating challenge and boring simplicity. The teacher of the handicapped needs to anticipate all the more in order to protect his/her children from continuously experiencing failure.

Kelly's (1955) development of a cognitive dissonance model of personality and DeCharm's (1968) notion of the attribution process suggest how a person's understanding constantly undergoes modification through anticipation and reality testing: On the basis of his past experiences a person derives a set of hypotheses, generalizations, and

principles which constitute his understanding. From this base he anticipates the moves of others. If the ensuing event coincides with and confirms his/her anticipation, the person's understanding is strengthened; if it contradicts the anticipation, the basic hypotheses are suitably modified to expand his/her understanding. (See Figure 1)

An example by Baum (1973) illustrates how this process operates in the case of a teacher's understanding of retarded children in his/her classroom. This teacher spends the first day of school having the students tell about their summer experiences. One student speaks with above-average verbal fluency while another has major problems in communication. This experience provides a base of understanding for the teacher. On the second day of school, the teacher asks the students to write their names, addresses, and parents' first names. The teacher anticipates that the child who demonstrated superior verbal abilities on the previous day will perform well and the other child poorly on this assignment. In evaluating the written assignments, the teacher notes that his anticipation about the verbally adept student is wrong: his writing is below average, just as poor as the other child's. Lack of confirmation of the anticipation results in the teacher's better understanding of the relationship between oral and written expression.

To Improve Understanding

This model suggests that understanding is expanded and strengthened through making repeated anticipations and comparing them with actual outcomes. Obviously, experience is a good teacher and on-the-job teacher training has appealing face validity. However, some limitations become apparent: the teacher being trained on the job may have to wait a long

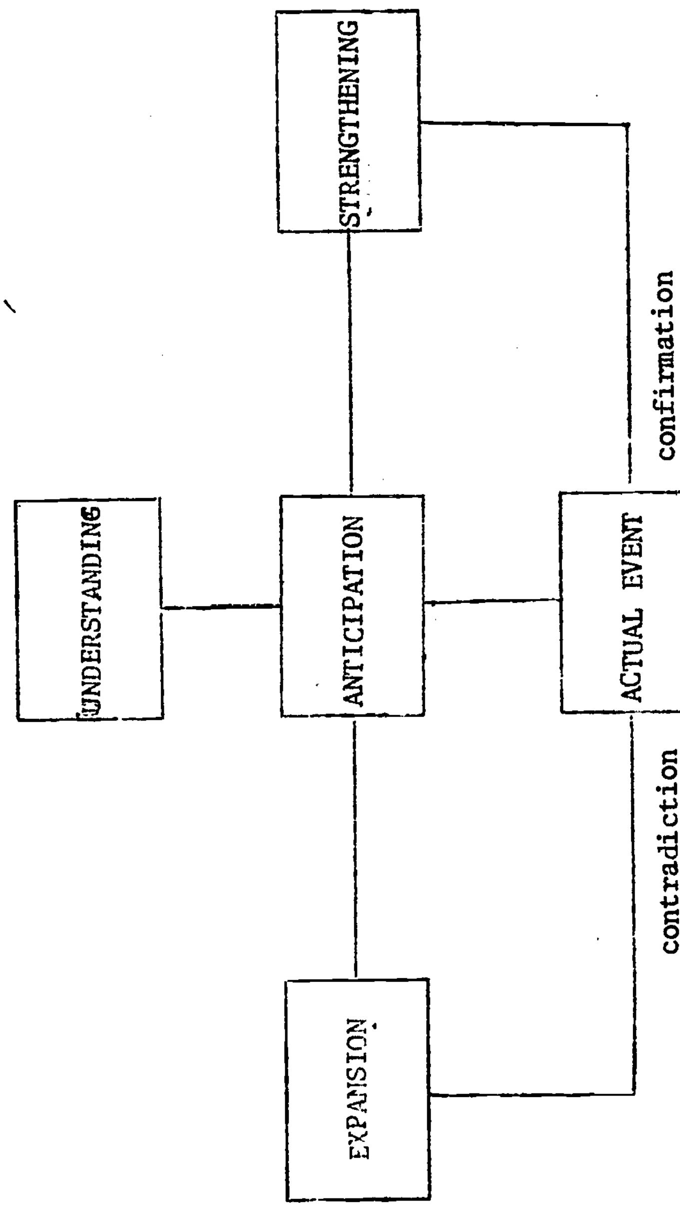

Figure 1. Relationship between understanding and anticipation.

time before he/she is able to experience the desired variety of outcomes. He/she may be under pressure to cope with the current reality and may not have the time to anticipate. The time lag between anticipation and the actual outcome may be so great that the effects of the feedback are minimal.

The traditional approach to providing the teacher with an understanding of children is through introductory courses. In lectures and textbooks, the teacher trainee is presented various facts about individual and group differences among learners. This approach has been notoriously inefficient and, in most cases, textbook principles have very little relevance to the realities of the classroom. Principles taught in these courses are of questionable validity. Further, this approach deprives the teacher of any opportunity for learning through anticipating.

An alternative approach to providing knowledge and understanding to teachers in training is becoming popular. This involves the use of protocol materials (Smith, 1969) which are recordings (usually on audio or videotape) of classroom interactions exemplifying educationally relevant concepts and generalizations. Through a study of these transcripts and reproductions of real-life behavior, the teacher trainee acquires a deeper understanding of such behavior. However, the actual use of protocols by themselves has turned out to be inefficient because the trainee becomes a passive receiver of information. He/she is not required to anticipate actively and check actual events. Because of the nature of the concepts they portray, most protocols are considered extremely dull.

At the Center for Innovation in Teaching the Handicapped, we have

developed a series of inexpensive card-and-board games (Semmel, 1972) which improve upon the advantages of using protocols and on-the-job training. Specific details of one of the games, THINK STRAIGHT, are given in the appendix. The games require the player to anticipate repeatedly the responses of different types of children to different task requirements. Players receive immediate feedback based on empirical data. The winner for each round of the game is the player whose anticipation is the closest to the actual outcomes. The greatest instructional strength of the game lies in the fact that the success of the player is judged not by expert opinion, nor by particular generalizations about children, but by actual normative data. Thus, feedback to the player is as realistic as the feedback to the classroom teacher. By providing a large number of anticipation-feedback cycles in a limited period of time, the game adds systematic efficiency to the reality of the classroom.

Design and Development of Anticipation Games

As we indicated earlier, a number of different anticipation games have been produced at the Center for Innovation in Teaching the Handicapped. In the process, we have also evolved a generalized procedure for the design and development of such games. This procedure involves three stages: analyzing people and situations; collecting normative data on the behavior of different people in these situations; and, choosing a suitable game format to incorporate these norms.

Analysis

Although the Center's major interest is in the training of teachers of the handicapped, anticipation games are usable in any situation where

the training objective calls for an understanding of people and their behavior. There are two particular instructional situations where these games are especially effective: One is a situation in which previous experience and prejudices interfere with objective understanding and the second is a situation in which blind faith in glowing generalities is likely to result in disillusionment.

Anticipation involves a person and a situation. In this analysis phase, the target group of people is identified and categorized into subgroups on the basis of such variables as sex, race, age, education, or any other relevant variable. Similarly, the situations in which the behavior of these people is to be anticipated are also carefully analyzed and categorized.

Collecting Normative Data

The heart of the anticipation game is a number of situations representative of those in real life where the target population's behaviors are to be anticipated. In the sample game described in the appendix, we are interested in a test-like situation. This requires the creation of a set of cards with test items from different subject-matter areas and at different levels of difficulty. Once a suitable set of situations is created (i.e., test items), the next step is to collect normative data on the actual behavior of different subgroups of the target population. This process is very similar to the standardization of a test. It involves locating appropriate groups, choosing random samples, having the subjects respond in standard situations, collecting data on their behavior, and reducing the data to convenient norms. Although time consuming and expensive, this process is the most important one in the

development of the anticipation game since it guarantees external validity. Some short-cut procedures may be used to speed up the process or at least provide the first approximation of norms.

Using existing data. Tables found in research literature are too condensed to be of use in the development of anticipation games. However, original investigators may be contacted for their raw data. Such data, obtained during the standardization of tests in various subject-matter areas or from surveys and interviews, may be used as the base for anticipation games. This approach was used in the development of the game described in the appendix.

Student-collected data. Students may take part in the process of collecting data with the usual result of increased learning from the game they helped to develop. By requiring individuals or small groups of students enrolled in the course to collect data on a standardized form from various subsections of the target population, a large data pool is generated.

Data on individual subjects. In appropriate situations, the anticipation game may concentrate on individual subjects instead of representative groups. Although these norms may be of limited generalizability, developing a game around individual subjects may prove to be of didactic value in emphasizing individual differences and the variability of individual behavior.

Artificial data. Suitable "data" may also be generated on the basis of a theoretical model or a conceptual framework. In the development of certain games we have programmed a computer to print out normative

data within given parameters and with random variability. However, unless the model used as the base has empirical validity, such data may oversimplify reality and mislead the student.

Choosing a Game Format

Normative data may be incorporated in a wide variety of different board-and-card game formats. The two dimensions of people and situations suggest matrix game formats. The classification of either people or situations indicates rummy-type games. We have experimented with over two dozen varieties and found each suitable to achieve a slightly different purpose. A good anticipation game should have all the features of any good game: simple and fair rules; optimum amount of chance; continuous participation by all players; and, fast pace. In addition, to be effective in training, these games should require players to make repeated anticipations, provide them with scores which are inversely related to the differences between actual and estimated values.

Evaluation

The effects of anticipation games have been evaluated in a number of different studies at the Center for Innovation in Teaching the Handicapped. The results of four studies are summarized below:

Study I

Semmel, Garrett, D. Semmel, & Wilcove (1973) undertook this study to determine how accurately different groups of college students anticipate educable mentally retarded (EMR) and nonretarded children's responses to a set of questions. Although no game was involved in this study, its findings about individual variations in anticipation are of

interest to the designer and user of the game. The study was undertaken in two phases: The first phase involved collecting a normative data base; the second, investigating anticipation moves of college students.

Phase I

Subjects. Sixty-five boys between the ages of 11 and 14 with IQs ranging from 60 to 89 were used as the EMR group. Sixty-six children (50 boys, 16 girls) between the ages of 10 and 14 with IQs ranging from 90 to 116 were used as the nonretarded group.

Materials. Twenty-four test questions, each on an individual card, were used in this phase.

Procedure. The test was administered orally to each individual child using a standardized procedure. The children were assured that this was not a regular classroom test. Between administrations, question cards were shuffled to prevent any serial order effects.

Results. Free responses of the children were recorded and the most frequent responses were identified. In 16 out of 24 questions, the most frequent responses given by both the nonretarded and EMR groups were identical. Differential responding was the greatest with questions which required imaginative free-association responses, intermediate with problem-solving questions with more than one correct solution, and least with problem-solving questions with only one correct solution.

Phase II

Subjects. Seventy-seven men and 213 women from courses in undergraduate educational psychology, undergraduate psychology, undergraduate special education, and graduate special education at Indiana

University were involved in this study.

Materials. A questionnaire, consisting of the 24 questions that were used to collect the normative data base, was prepared. The 10 most frequent responses of children were listed below each question and the subjects were instructed to indicate which response would be most commonly given by each group of children.

Procedure. The questionnaire was presented during a regular class session. Demographic information was also collected from each subject.

Results. The range of correctly anticipated responses of EMR children was 0-15; the range for nonretarded children was 5-18. Six subject variables--sex, age, academic major, semester hours in special education courses, experience with EMR children, and the course in which the subject was currently enrolled--were analyzed individually in a two-way fixed analysis of variance design with repeated measures over the effects of the two samples of children (EMR and nonretarded). The results of these analyses and Scheffe's post-hoc comparisons are given in Table 1.

TABLE I

Effects of Subject Variables on Anticipation

Subject Variable	Main effect of variable	Interaction
Sex	Significant ($p < .05$). Women had higher scores (mean = 9.5, s.d.= 2.6) than men (mean = 8.9, s.d., = 2.9).	Significant interaction between sex and type of children ($p < .05$). Women scored significantly better than men in anticipating the responses of EMR children.
Age (18-19, 20-21, 22-23, and 24+	Significant ($p < .05$). 24+ group scored significantly better than 22-23 group ($p < .05$).	--
Academic major (Special education, elementary education, secondary education, psychology, and others)	Significant ($p < .001$). Special education majors predicted more accurately than psychology and other majors.	--
Semester hours in special education (0, 1-3, 4-6, 7-9, 10-12, and 13+)	Significant ($p < .01$). *Post-hoc* analyses showed no significant differences although the 13+ group had the greatest mean score while both the 0 and 7-9 groups had the lowest scores.	--
Experience with EMR children (None, little, moderate, and extensive)	Significant ($p < .01$). Subjects with extensive experience anticipated children's responses better than those with none ($p < .01$) or little ($p < .05$).	Significant interaction between experience and type of children ($p < .05$). Subjects with extensive experience anticipated EMR responses better than those with none ($p < .05$).
Current course enrollment (undergraduate special education, undergraduate educational psychology, undergraduate psychology, graduate special education)	Significant ($p < .05$). *Post-hoc* analyses showed no significant differences although undergraduate and graduate special education courses had the highest scores.	Significant interaction between type of courses and type of children ($p < .05$).

Study II

This pilot study was undertaken by Semmel and Sivasailam (1971) during the formative evaluation of the anticipation game TRUE GRID (Semmel, 1972). The object of the study was to investigate the effects of repeated playing of the game.

Subject. A single, foreign-born, 20-year-old, female subject was used in this study. The subject did not have any previous knowledge of, or experience in, the education of handicapped children.

Materials. TRUE GRID is a two-person anticipation game which uses a 4 x 3 grid. Moves in the game involve anticipating the percentage of three different types of children (normal, 66-80 IQ group, and 50-65 IQ group) at three different age levels (9, 11, and 13) who responded to questions from four different subject-matter areas (arithmetic, language, reading, and work-study). The scoring system of the game discourages players from concentrating on a specific subject-matter area or a specific type of child. More than 150 questions are used in the game to prevent any practice effect. Normative data on these questions came from an earlier study (Meyen & Hieronumus, 1970) which surveyed 1,405 children.

Procedure. The experimental subject played a total of 20 games, each with a different opponent, over a period of three weeks. Anticipations during each round of the game were recorded on response sheets which provided a cumulative record for later analysis. At the end of each game, the subject was debriefed and asked to list any new rules of strategy she discovered during the play of the game.

Results. Each anticipated percentage was compared to the actual percentage from the norms and a deviation score was computed. These

deviation scores became smaller as a function of the number of rounds of the game played, indicating increased accuracy in anticipation. The results revealed that the rate of learning to anticipate was most rapid for the highest (normal) and the lowest (50-65 IQ) groups respectively The rate of learning to anticipate for the intermediate (66-80 IQ) group was the slowest. There was also a positive relationship between the rate of learning and the age of pupils for whom predictions were made.

Of the 84 strategy statements listed by the subject during the debriefing sessions, 27 dealt with game moves (e.g., "Begin with a corner cell and work toward the center."). Among the remaining were developmental generalizations (e.g., "There is very little difference between 11- and 13-year-old normal children in their responses to these language questions."), principles relating to IQ levels and performance (e.g., "Retarded children are harder to predict. They are less stable."), insights into subject-matter areas (e.g., "Arithmetic problems which involve fractions are the toughest for all children.") and test characteristics (e.g., "If a child does not know the answer he is more likely to choose the first or last alternative than any of the middle ones."). Many of these principles discovered by the subject are comparable to those found in introductory textbooks on methods of teaching retarded children.

Study III

Having informally established that the player does learn to make more accurate predictions as a result of playing TRUE GRID, another pilot study Zimmerman,(1973) was undertaken to investigate if this skill transfers to the anticipation of student behavior in the teacher-player's classroom.

Subjects. Nine intern teachers from the University of Louisville were involved in this study. They were randomly assigned to experimental (n=5) and control (n=4) groups.

Materials. The TRUE GRID game was again used in this study. In addition, a 24-item test which contained questions similar to the ones used in the game was also constructed. The questions were from the areas of vocabulary, spelling, and arithmetic. The test was available in two different forms: one was for direct administration to retarded children and the other, a questionnaire for teachers' predictions.

Procedure. Five interns played TRUE GRID while the other four played an unrelated game in separate classrooms for a period of two hours. The groups were brought back together and given the 24-item questionnaire which required them to predict the percentages of children in their classrooms who would correctly answer each question. Each subject took back with him copies of the test which contained the same 24 questions and administered it to the children in his classroom using a standardized procedure. Children's responses were returned directly to the investigator for analysis.

Study IV

The lack of more impressive transfer of anticipation skills to the classroom in the previous study could have been partly due to the normative data base of the game differing from that of local students. Baum (1973) created a normative data base from local students to study the learning and transfer from a game incorporating that data. In the most comprehensive study of anticipation games undertaken to date, he also attempted to cross validate the findings from earlier pilot studies.

Phase I: Collecting a normative data base

Subjects. Two hundred and ninety students in special classes for the educable mentally retarded (EMR) in five junior high and three senior high public schools in Cincinnati, Ohio were used as subjects. One hundred and sixty-six of the sample were male and 124, female. Their ages ranged between 13 and 19, their IQs, between 50 and 80.

Materials. A 70-item multiple-choice test based on the Persisting Life Problem areas identified in the Cincinnati curriculum guide for the EMR was developed by the investigator.

Procedure. The test was administered to students in classrooms in the absence of their teachers. The students were told that none of their teachers would see their answers and their performance would not affect their grades. The investigator presented each question orally and repeated it if requested by any student. Demographic data were obtained from school records.

Results. Students were sorted into four groups according to age levels (younger--13-15; older--16-19) and IQ levels (lower--50-64;

higher 65-80). Test results were analyzed and a frequency distribution in percentages was obtained for responses by each of the four groups of students.

Phase II: Treatment and assessment of anticipation skills

Subjects. Thirty teachers (whose students had been involved in Phase I) were subjects in this phase. Eighteen teachers were male and twelve, female. All had training and experience in teaching EMR children. The teachers were randomly assigned, within their schools, to either an experimental or a control condition.

Materials. The normative data collected in Phase I was incorporated into a two-person anticipation game called BATTLE CHIPS while the control subjects played a two-person commercial game called PERCEPTION. During the first session subjects played games from 25 to 45 minutes, depending upon the free time available. Question cards used in this session were removed before the next one began. This session terminated when each player completed 30 rounds of the game.

Results. A deviation score for each anticipation given by the experimental players was calculated by subtracting the predicted percentages from the actual values. The types of analyses and the results are summarized in Table 2.

TABLE 2

Effects of Playing BATTLE CHIPS

Variables	Analysis	Result
Effect of playing BATTLE CHIPS on accuracy of anticipation.	Serial analysis of variance (7 dyads x 3 sets of ten rounds of the game)	Accuracy increased significantly ($p < .05$) as a function of number of rounds played.
Realtionship between teacher characteristics (age, sex, type of class taught, educational level, teaching experience, and impressions of the game) and accuracy of anticipation.	Correlational analyses	No significant relationships.
Relationship between teacher characteristics and overestimates in anticipation.	Correlational analyses	No significant relationships.
Relationship between student characteristics (age and IQ level) and accuracy of anticipation.	Analysis of variance	No significant effects.

Phase III: Transfer of anticipation skills

Subjects. Same as those in the previous phase.

Materials. A 20-item criterion test was developed from the earlier 70-item test on the basis of a factor analysis which identified the five factors of (a) map reading and arithmetic, (b) practical-functional, (c) spelling, (d) synonyms, and (e) number usage. Items which had rotated factor loadings over .40 and which represented several areas of the curriculum were included in this criterion test.

Procedure. The names of five high-IQ-level and five low-IQ-level children were selected randomly from the total homeroom class lists of each teacher. These names were randomly listed at the top of the criterion test. Each teacher was required to predict which multiple-choice alternative each of these children would choose for each test item.

Results. Predictions were scored as correct if the teacher selected the same alternative the particular student had chosen earlier. A comparison of accuracy of anticipation between experimental and control subjects was accomplished through a one-way analysis of variance which did not yield any significant difference. A number of other hypotheses were also tested and the results of some of these are summarized in Table 3.

Future Activities

The findings of the Semmel et.al. (1973) study demonstrate that anticipation is a complex phenomenon warranting further investigation. While we study individual differences among anticipators, our game development activities continue to expand. From the cognitive verbal responses of children in test-like situations, we are moving into

TABLE 3

Transfer of Effects of Playing BATTLE CHIPS

Variables	Analysis	Result
Relationship between students' IQ levels and accuracy of anticipation.	2 x 2 Analysis of variance	Significant ($p < .01$). Performance of high-IQ EMRs were more accurately anticipated.
Relationship between factor analytic component of questions and accuracy of anticipation.	2 x 5 Analysis of variance and planned comparison.	Significant ($p < .05$).
Relationship between teachers' assessment of the general ability levels of children and accuracy of anticipation.	Correlational analysis	Significant ($p < .01$) positive correlation.

affective reactions of different children (e.g., emotionally disturbed) to different classroom climates presented through videotape segments. In the evaluation of anticipation games, we are currently expecting three types of validation: internal validation which measures the extent to which players learn anticipation skills within the context of the game; transfer validation which measures the transfer of these skills to relevant classroom behavior; and payoff validation which measures the effects of these increased skills on the motivation and learning of the handicapped child.

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Appendix

THINK STRAIGHT

Equipment

1. Question cards. There are question cards of three different colors representing the three subject-matter areas of reading, language, and arithmetic. On one side of the card there is a multiple-choice question. The other side contains a table of percentages of children (grouped by age and IQ level) responding correctly to the question. (See Figure 2.)

2. Board. The playing board is a 3 x 3 grid in which the rows represent normal, 50-65 IQ group, and 66-80 IQ group; the columns represent three subject-matter areas of reading, language, and arithmetic.

3. Poker chips of two different colors.

Players

This game may be played by two players or two teams of players. Each player or team is identified by poker chips of the same color.

Object

The object of the game is to get three poker chips of the same color in a straight line (vertical, horizontal or diagonal) on the board just as in tic-tac-toe. Only one chip may occupy any given square.

Play

1. Both players agree beforehand as to a specific age to be used in the game. One of the players asks for a question for a given type of children in a given curricular area (e.g., "I want a work-study question for a normal child."). The other player removes a random card from the deck containing questions on the specified area.

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Arithmetic Skills: Concepts

Choose the best answer.

Jack has 12 marbles and gave 25% of them to Ralph. How many marbles did he give to Ralph?

1) 3
2) 6
3) 9
4) 10

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Age	9	10	11	12	13	14
EMR Group	14	11	13	15	12	16
50-65 IQ Group	15	14	12	24	11	16
60-80 IQ Group	13	10	14	13	12	16
Normal Group	19	41	58	71	80	71

Fig. 2 A sample question card for the THINK STRAIGHT game

2. The first player writes down a percentage prediction. The other player may challenge this by writing down a different figure.

3. The board is turned over to get the actual percentage. Whichever player has a percentage prediction closest to the actual percentage wins the round and places a chip of his color on the appropriate cell. If the first player was not challenged, he wins if his prediction is within 5 percentage points of the actual value.

4. Play continues with the other player specifying the cell he wants to play for. A player wins if he is able to get three of his chips in a straight line.